

REMARKS/ARGUMENTS

STATUS OF THE CLAIMS

Prior to the filing of this Response, claims 1-5 and 14-20 were pending in the current application. By this Amendment, claims 1, 4, 15, and 16 are amended, and claim 3 is canceled, leaving claims 2, 5, 14, and 17-20 unchanged. Claims 6-13 were canceled in a previous Amendment.

CLAIM REJECTIONS – 35 U.S.C. §103

On pages 2 and 3 of the Office Action, claims 1-5 and 14-20 are rejected under 35 U.S.C. §103(a) as being unpatentable over the combined teachings of Stewart (U.S. Patent No. 4,295,067) and Chisholm (U.S. Patent No. 3,965,970).

Independent Claims

Claim 1 is hereby amended, and calls for:

A heat transfer device for removing heat energy from a plurality of electronic components separated from one another, the heat transfer device comprising:

a heat exchange structure containing a working fluid in a substantially closed envelope defining an evaporator and a condenser that are coupled by a vapor line and a liquid return line to provide a circulating path for the working fluid, through vaporization of a liquid phase of the working fluid at the evaporator, condensation of a vapor phase of the working fluid at the condenser, and return of the working fluid from the condenser to the evaporator through said liquid return line;

wherein the evaporator comprises a bottom wall having a first portion at least partially defining a reservoir, and second and third portions elevated with respect to the first portion and each at least partially defining a respective evaporation chamber adjacent the reservoir, the reservoir in flow communication with the liquid return line and positioned below a turret that defines a vapor accumulator arranged in flow communication with said vapor line, the evaporation chambers separated by the reservoir, each of the second and third portions of the wall positioned for application of heat energy from distinct ones of the electronic components, and said two evaporation chambers commonly supplied with the liquid phase of the working fluid from the reservoir that is below said vapor accumulator;

a wicking material on the second and third portions of the bottom wall, wherein the reservoir contains the liquid phase of the working fluid to a level that is disposed below said evaporation chambers, covering the first portion of the bottom wall with the liquid phase, and leaving the wicking material on the second and third portions of the bottom wall exposed.

(Amendment marks not shown)

Claim 15 is hereby amended, and calls for:

A heat transfer device for removing heat energy from a plurality of electronic components separated from one another, the heat transfer device comprising:

a heat exchange structure containing a working fluid in a substantially closed envelope defining an evaporator including a vapor accumulator in flow communication with a vapor line, a condenser coupled to said evaporator by said vapor line, and a liquid return line to provide a circulating path for the working fluid, through vaporization of a liquid phase of the working fluid at the evaporator, condensation of a vapor phase of the working fluid at the condenser, and return of the working fluid from the condenser to the evaporator through said liquid return line;

wherein the evaporator comprises a bottom wall having a first portion at least partially defining a reservoir, and second and third portions elevated with respect to the first portion and each at least partially defining a respective evaporation chamber adjacent the reservoir, the reservoir in flow communication with the liquid return line, the two evaporation chambers separated by the reservoir, each of the second and third portions of the wall positioned for application of heat energy from distinct ones of the electronic components and commonly supplied with the liquid phase of the working fluid from the reservoir;

a wicking material on the second and third portions of the bottom wall, wherein the reservoir contains the liquid phase of the working fluid to a level that is disposed below said evaporation chambers, covering the first portion of the bottom wall with the liquid phase, and leaving the wicking material on the second and third portions of the bottom wall exposed.

(Amendment marks not shown)

Claim 16 is hereby amended, and calls for:

A heat transfer device for removing heat energy from a plurality of electronic components separated from one another, the heat transfer device comprising:

a heat exchange structure containing a working fluid in a substantially closed envelope defining (i) an evaporator including a turret that defines a vapor accumulator arranged in flow communication with a vapor line, and (ii) a condenser that is coupled to said evaporator by said vapor line and said liquid return line so as to provide a circulating path for the working fluid, through vaporization of a liquid phase of the working fluid at the evaporator, condensation of a vapor phase of the working fluid at the condenser, and return of the working fluid from the condenser to the evaporator through said liquid return line;

wherein the evaporator comprises a bottom wall having a first portion at least partially defining a reservoir, and second and third portions elevated with respect to the first portion and each at least partially defining a respective evaporation chamber adjacent the reservoir, the reservoir in flow communication with the liquid return line, the evaporation chambers separated by the reservoir, each of the second and third portions of the wall positioned for application of heat energy from distinct ones of the electronic components, said two evaporation chambers commonly supplied with the liquid phase of the working fluid from the reservoir;

a wicking material on the second and third portions of the bottom wall, wherein the reservoir contains the liquid phase of the working fluid to a level that is disposed below said evaporation chambers, covering the first portion of the bottom wall with the liquid phase, and leaving the wicking material on the second and third portions of the bottom wall exposed.

(Amendment marks not shown)

In contrast, Binder discloses a heat pipe 30 for cooling rectifying diodes 9 each positioned in a respective vertically disposed well-like recess 32 in a side wall of an evaporation region 30a, and a transition region/tube 30c laterally extending from the evaporation region 30a to a condensation region 30b (see Figs. 9 and 10 of Binder). Importantly, the structure and orientation of the heat pipe 30 disclosed by Binder is specific to the application (i.e., the orientation of the electronic components requiring cooling), and as such provides a wick structure on the inner surfaces of the heat pipe 30 to aid in distribution of the working fluid to the diodes positioned at various elevations on one side of the evaporation region. However, Binder does not teach, disclose, or suggest, among other things, a heat transfer device including an

evaporator having a bottom wall including “second and third portions elevated with respect to the first portion and each at least partially defining a respective evaporation chamber,” and the evaporation chambers “commonly supplied with the liquid phase of the working fluid from the reservoir” as claimed in claims 1, 15, and 16. Further, Binder fails to teach, disclose, or suggest, the bottom wall having “a first portion at least partially defining a reservoir... wherein the reservoir contains liquid phase of the working fluid to a level that is disposed below said evaporation chambers, covering the first portion of the bottom wall with the liquid phase, and leaving the wicking material on the second and third portions of the bottom wall exposed” as claimed in claims 1, 15, and 16.

In this regard, the Applicants note that the terms of orientation called for in claims 1, 15, and 16 (i.e., “bottom”, “below”, and “elevated”) cannot be disregarded in the application of prior art to the claims, since the relative orientations of the various portions of the heat transfer devices claimed in claims 1, 15, and 16 are relevant to the functioning of the claimed devices. However, even if the orientation of the heat pipe of Binder is ignored (and the Applicant respectfully submits that it cannot be), and a level of liquid phase of the working fluid is provided so that the “reservoir” in Binder is the area surrounding the well-like recesses containing the diode, it is reasonable to expect that the function of the heat pipe would be compromised, because the liquid pooled in contact with the resulting submerged heat transfer surfaces of the evaporator would prevent optimal heat transfer.

Chisholm fails to cure the deficiencies of Binder, and is cited for its disclosure of a condensate reservoir and a connection tube for return of condensed liquid. Thus, neither Binder, nor Chisholm, nor any combination of the two teach, disclose, or suggest, among other things, a heat transfer device including an evaporator having a bottom wall including “second and third portions elevated with respect to the first portion and each at least partially defining a respective evaporation chamber,” with the evaporation chambers “commonly supplied with the liquid phase of the working fluid from the reservoir” as claimed in claims 1, 15, and 16. Further, neither Binder, nor Chisholm, nor any combination of the two teach, disclose, or suggest a bottom wall having “a first portion at least partially defining a reservoir... wherein the reservoir contains liquid phase of the working fluid to a level that is disposed below said evaporation chambers,

covering the first portion of the bottom wall with the liquid phase, and leaving the wicking material on the second and third portions of the bottom wall exposed” as also claimed in claims 1, 15, and 16.

It should also be noted that Binder fails to teach, describe, or suggest a separate liquid return line as claimed in claims 1, 15, and 16, and while Chisholm does, one of ordinary skill in the art would not be motivated to modify Binder to provide a separate return line. The transition region and wick of the heat pipe disclosed by Binder accomplishes the purpose of transferring a liquid phase of working fluid from a condenser to an evaporator already, in addition to providing a conduit for vapor flow from the evaporator to the condenser. Accordingly, no advantage or motivation exists for adding a separate return line to the device of Binder, as a separate return line would perform no function that is not already inherently performed by the Binder device (i.e., without additional unnecessary structure).

Dependent Claims

Claims 2, 4, 5, and 14 each ultimately depend from amended claim 1, and are therefore allowable based on independent claim 1 and upon other features and elements of claims 2, 4, 5, and 14 not specifically discussed herein. Claims 17 and 18 each depend from amended claim 15, and are therefore allowable based on independent claim 15 and upon other features and elements of claims 17 and 18 not specifically discussed herein. Also, claims 19 and 20 each depend from amended claim 16, and are therefore allowable based on independent claim 16 and upon other features and elements of claims 19 and 20 not specifically discussed herein.

In light of these and other reasons not discussed herein, the Applicant respectfully submits that claims 1-5 and 14-20 are novel and patentable over Binder and Chisholm. Accordingly, withdrawal of the 35 U.S.C. §103(a) rejection of claims 1-5 and 14-20 in view of Binder and Chisholm is respectfully requested.

On pages 2 and 3 of the Office Action, claims 1-3, 5, 14-17, and 19 are rejected under 35 U.S.C. §103(a) as being unpatentable over the combined teachings of Stewart (U.S. Patent No. 4,337,825) and Chisholm (U.S. Patent No. 3,965,970). Also, on pages 2 and 4 of the Office

Action, claims 4, 18, and 20 are rejected under 35 U.S.C. §103(a) as being unpatentable over Stewart and Chisholm in view of Binder.

Independent Claims

In contrast to the present invention as claimed in amended independent claims 1, 15, and 16, Stewart discloses an apparatus for heating water flowing through a pipe C contained within a manifold B to which are connected (via an upright conduit F and a collector pipe E) an array of heat tubes D, wherein the collector pipe E collects condensed liquid working fluid and distributes it to the heat tubes D for collection of the liquid working fluid therein. Fig. 2 of Stewart clearly shows the liquid pooled along the bottom of each heat tube D. However, Stewart fails to teach, disclose, or suggest, among other things, a heat transfer device including an evaporator having a bottom wall including “second and third portions elevated with respect to the first portion and each at least partially defining a respective evaporation chamber,” as claimed in amended claims 1, 15, and 16. Further, Stewart fails to teach, disclose, or suggest the bottom wall having “a first portion at least partially defining a reservoir... wherein the reservoir contains liquid phase of the working fluid to a level that is disposed below said evaporation chambers, covering the first portion of the bottom wall with the liquid phase, and leaving the wicking material on the second and third portions of the bottom wall exposed” as also claimed in amended claims 1, 15, and 16.

Chisholm fails to cure the deficiencies of Stewart, and is cited for its disclosure of a condensate reservoir and a connection tube for return of condensed liquid. Thus, neither Stewart, nor Chisholm, nor any combination of the two teach, disclose, or suggest, among other things, a heat transfer device including an evaporator having a bottom wall including “second and third portions elevated with respect to the first portion and each at least partially defining a respective evaporation chamber,” and the evaporation chambers “commonly supplied with the liquid phase of the working fluid from the reservoir” as claimed in amended claims 1, 15, and 16. Further, neither Stewart, nor Chisholm, nor any combination of the two teach, disclose, or suggest the bottom wall having “a first portion at least partially defining a reservoir... wherein the reservoir contains liquid phase of the working fluid to a level that is disposed below said evaporation chambers, covering the first portion of the bottom wall with the liquid phase, and

leaving the wicking material on the second and third portions of the bottom wall exposed” as also claimed in amended claims 1, 15, and 16.

It should also be noted that Stewart does not teach a separate liquid return line as claimed in amended claims 1, 15, and 16, and while Chisholm does, one of ordinary skill in the art would not modify Stewart to provide a separate return line. The upright conduit F and orientation of components in the Stewart structure (i.e., the evaporator positioned in the direction of gravity from the condenser) accomplishes the purpose of transferring the liquid phase of the working fluid from the condenser to the evaporator already, in addition to providing a conduit for vapor flow from the evaporator to the condenser. Accordingly, no advantage or motivation exists for adding a separate return line to the device of Stewart, as a separate return line would perform no function that is not already inherently performed by the Stewart device (i.e., without additional unnecessary structure).

Dependent Claims

Claims 2, 4, 5, and 14 each ultimately depend from amended claim 1, and are therefore allowable based on independent claim 1 and upon other features and elements of claims 2, 4, 5, and 14 not specifically discussed herein. Claims 17 and 18 each depend from amended claim 15, and are therefore allowable based on independent claim 15 and upon other features and elements of claims 17 and 18 not specifically discussed herein. Claims 19 and 20 each depend from amended claim 16, and are therefore allowable based on independent claim 16 and upon other features and elements of claims 19 and 20 not specifically discussed herein.

In light of these and other reasons not discussed herein, the Applicant respectfully submits that claims 1, 2, 4, 5, and 14-20 are novel and patentable over Stewart, Chisholm, and Binder. Accordingly, withdrawal of the 35 U.S.C. §103(a) rejection of claims 1, 2, 4, 5, 14-20 in view of Stewart, Chisholm, and Binder is respectfully requested.

CONCLUSION

In view of the above, the Applicant respectfully requests reconsideration and allowance of pending Claims 1, 2, 4, 5, and 14-20. The Examiner is invited to contact the undersigned Applicant's Representative if he believes a telephone conference would be helpful in advancing prosecution of this matter.

Respectfully submitted,



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